

The Role of Native Annual Forbs in the Restoration of Invaded Rangelands

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Restoration of degraded communities is costly and difficult.

- Weather
- Seeding method
 - Seeds
- Species mixes



Natural Succession

Disturbance → Annuals → Early seral
perennials → Late seral
perennials & shrubs



Seed Mix 1

- *Artemisia tridentata*
- *Elymus lanceolatus*
- *Leymus cinereus*
- *Poa secunda*
- *Pseudoroegneria spicata*
- *Achillea millefolium*

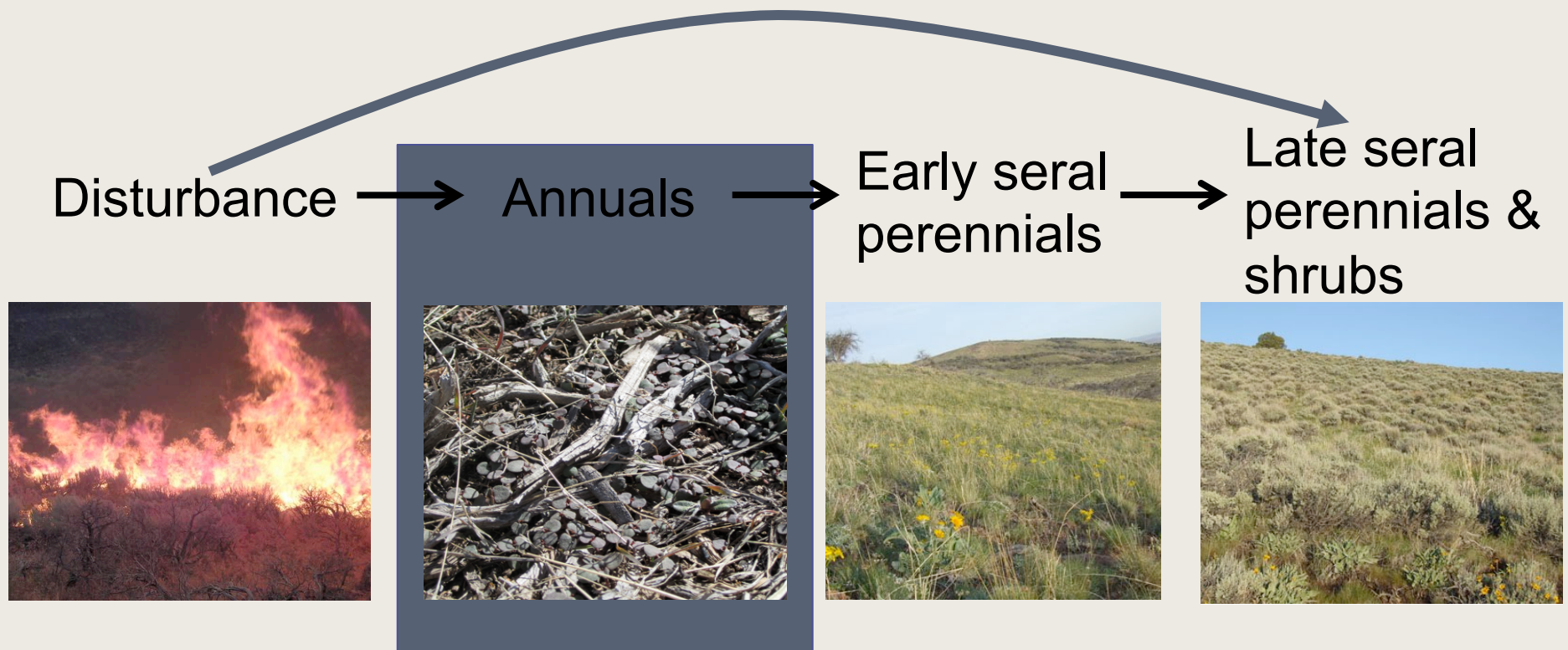
Seed Mix 2

- *Artemisia tridentata*
- *Achnatherum hymenoides*
- *Elymus lanceolatus*
- *Poa secunda*
- *Pseudoroegneria spicata*

Seed Mix 3

- *Artemisia tridentata*
- *Purshia tridentata*
- *Achnatherum hymenoides*
- *Agropyron crestatum*
- *Elymus lanceolatus*
- *Leymus cinereus*
- *Pascopyrum smithii*
- *Poa secunda*
- *Pseudoroegneria spicata*
- *Achillea millefolium*
- *Medicago sativa*

Can we improve restoration success by more closely following natural successional patterns?



Native annual forbs may be valuable restoration species for multiple reasons

1. Adapted to post-disturbance environmental conditions.
2. Likely to be phenologically similar to and competitive with cheatgrass.
3. Contribute to plant diversity and habitat in rangelands.

There is overlap in growth between native and introduced annuals!

Woollystar and tumble mustard

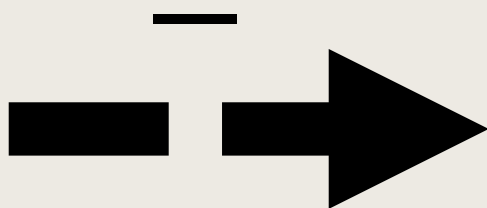


Blue-eyed Mary and cheatgrass

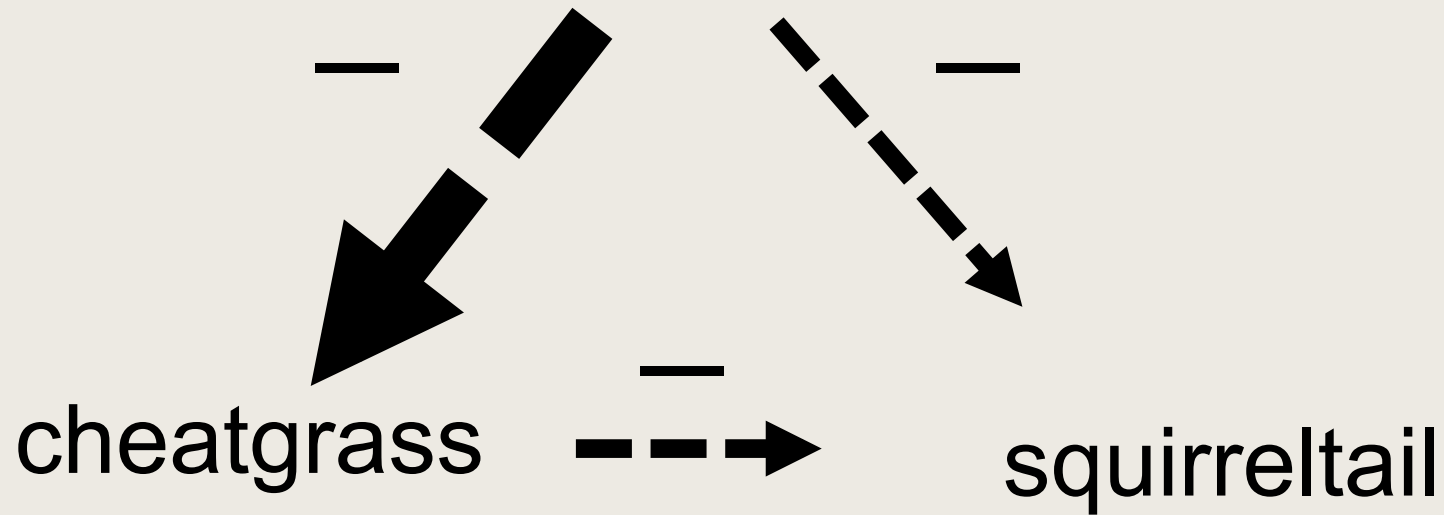


Fiddleneck and stork's bill

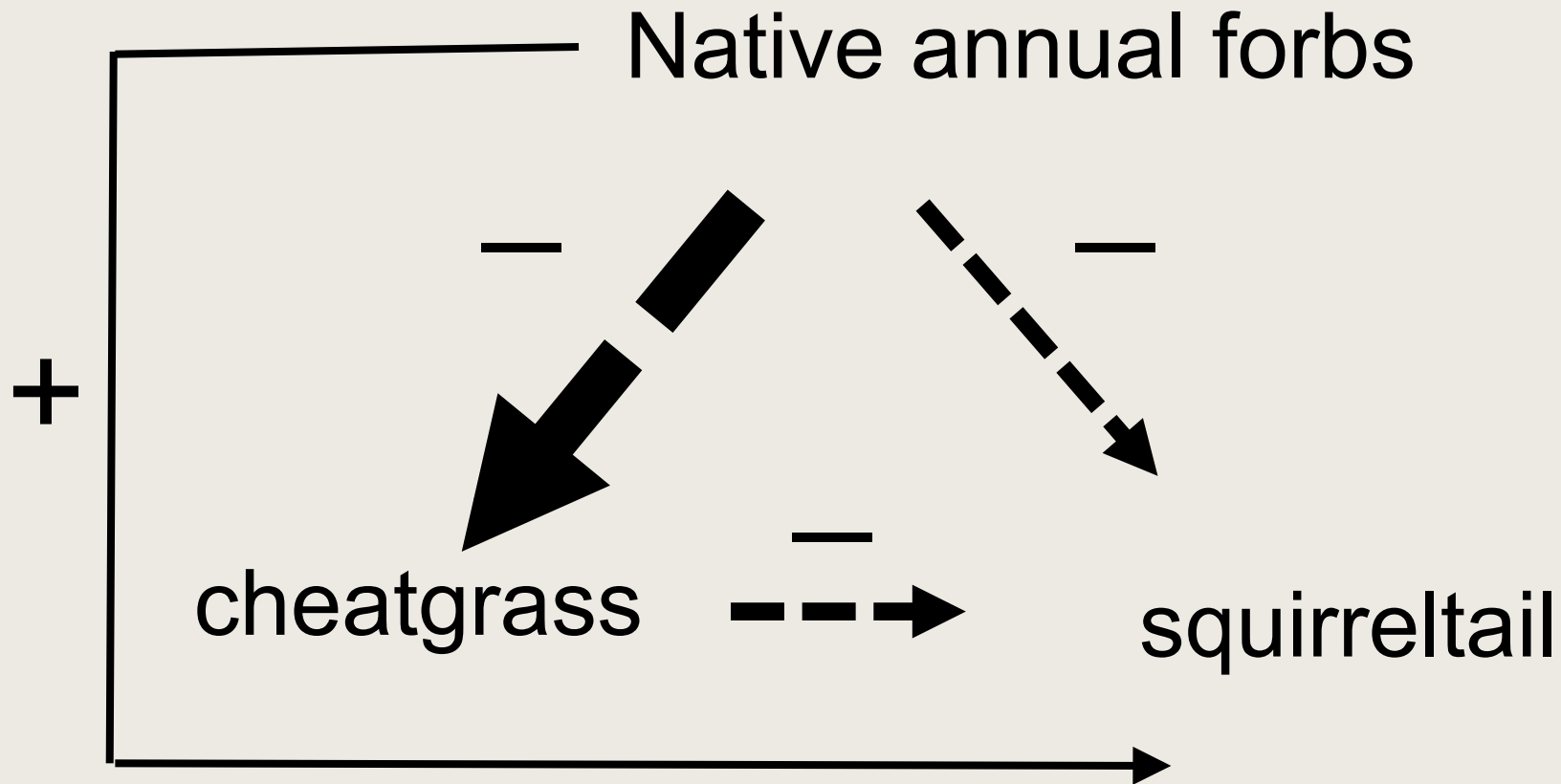


cheatgrass  squirreltail

Native annual forbs



Early interactions between native annual forbs and cheatgrass may reduce its early growth and vigor.



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Questions

1. What is the **direct** effect of native annual forbs on cheatgrass performance?
2. What are the **direct** and **indirect** effects of native annual forbs on squirreltail performance?

Greenhouse Experiments

Experiment 1: Direct effect of native annuals on cheatgrass.



Amsinckia tesellata
Bristly fiddleneck



Mentzelia veatchiana
Veatch's blazingstar

cheatgrass

cheatgrass+
fiddleneck

cheatgrass+
blazing star

cheatgrass
+ Mixed
Forbs

Greenhouse Experiments

Experiment 2: Direct and indirect effects of native annuals on squirrel tail.



Amsinckia tesellata
Bristly fiddleneck



Mentzelia veatchiana
Veatch's blazingstar



Cryptantha pterocarya
Wingnut cryptantha



Eriastrum sparsiflorum
Great Basin Woollystar

squirreltail

squirreltail+
fiddleneck

squirreltail+
blazing star

squirreltail+
Mixed Forbs

squirreltail
+
cheatgrass

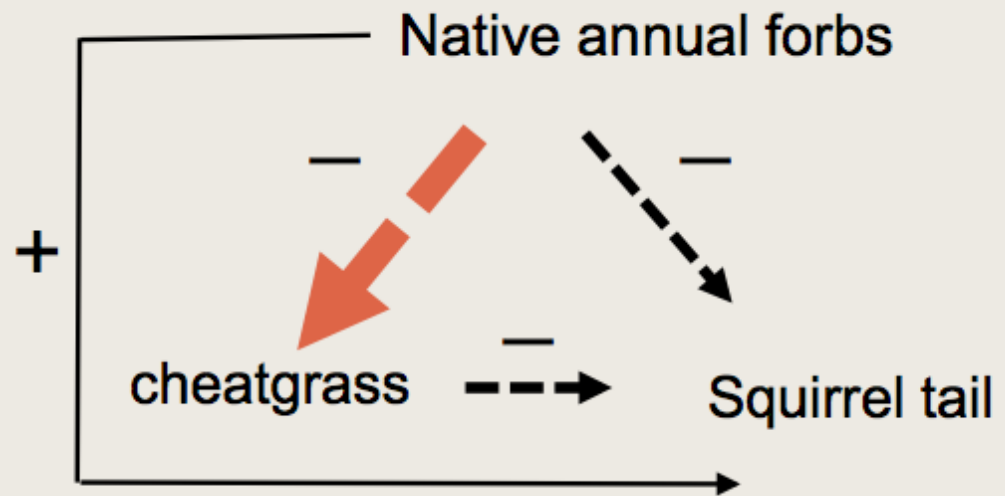
squirreltail+
cheatgrass
+ fiddleneck

squirreltail+
cheatgrass+
blazing star

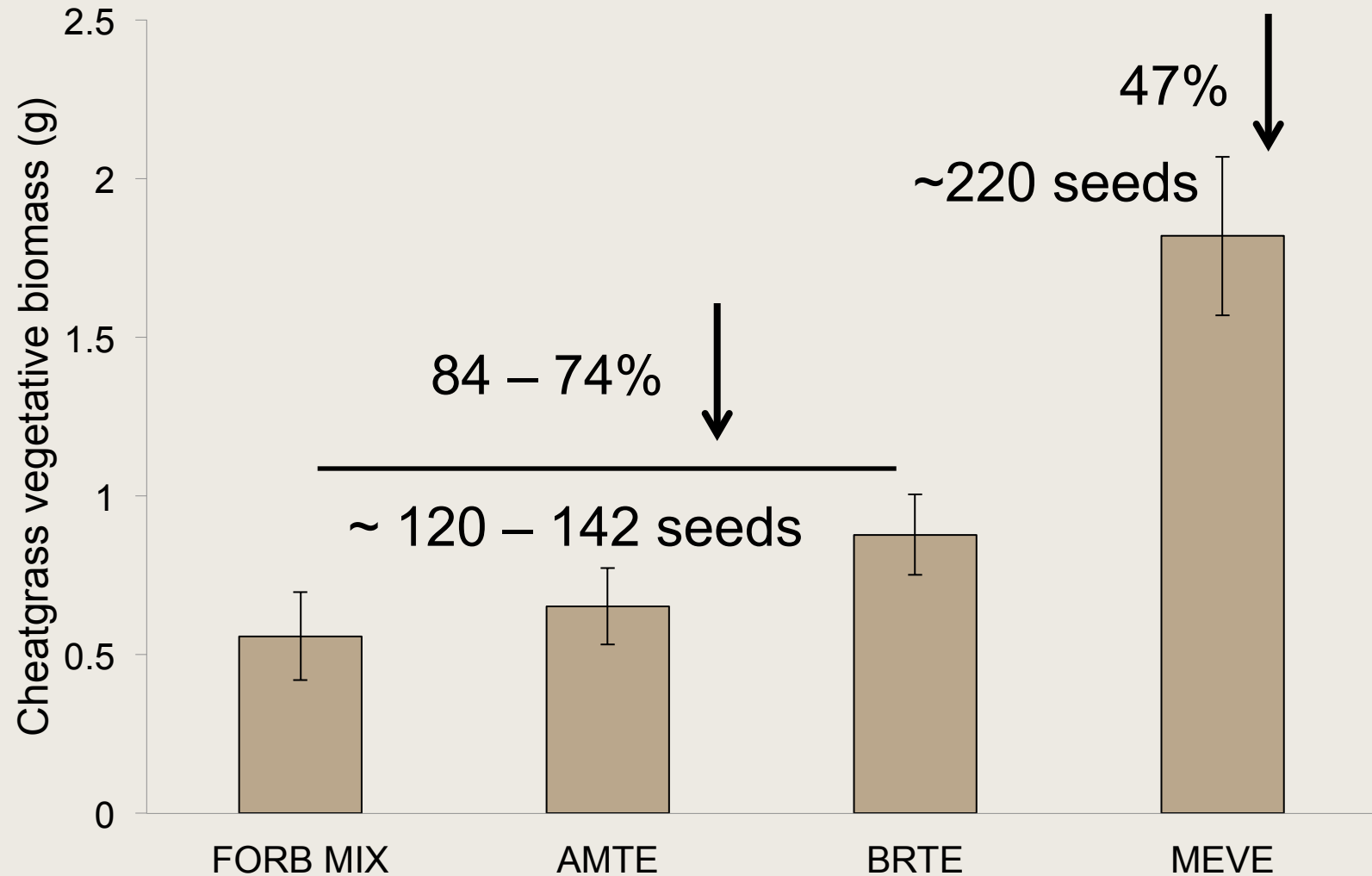
squirreltail+
cheatgrass+
Mixed Forbs

Questions

1. What is the **direct** effect of native annual forbs on cheatgrass performance?

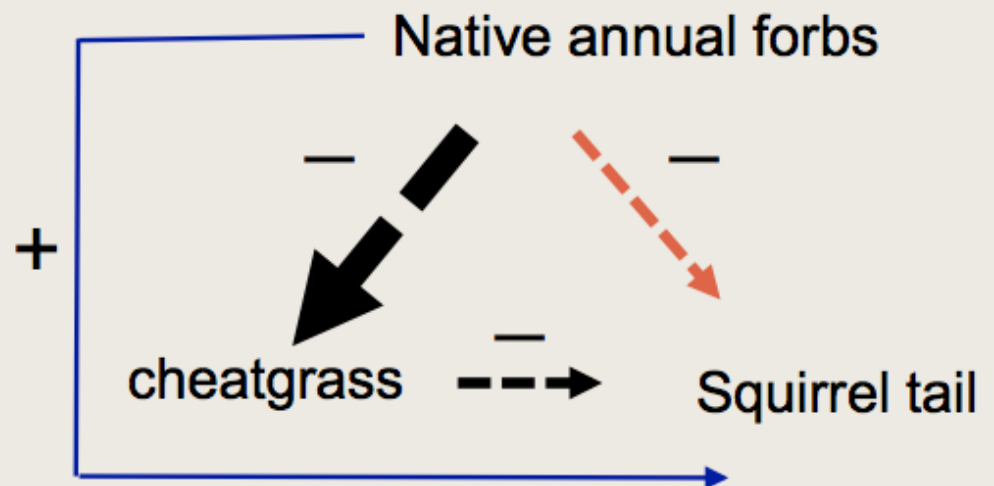


1. Fiddleneck is a good competitor against cheatgrass!

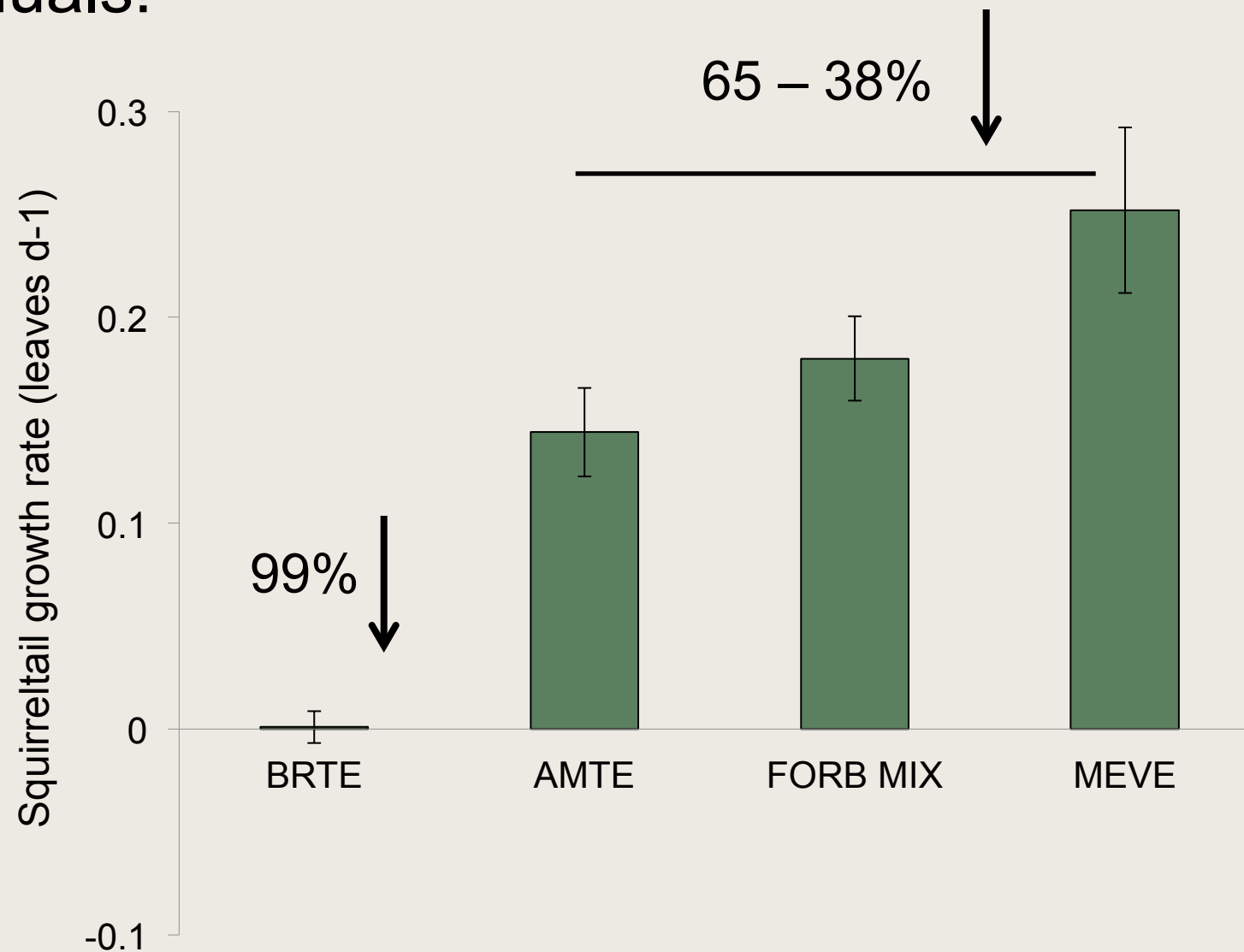


Questions

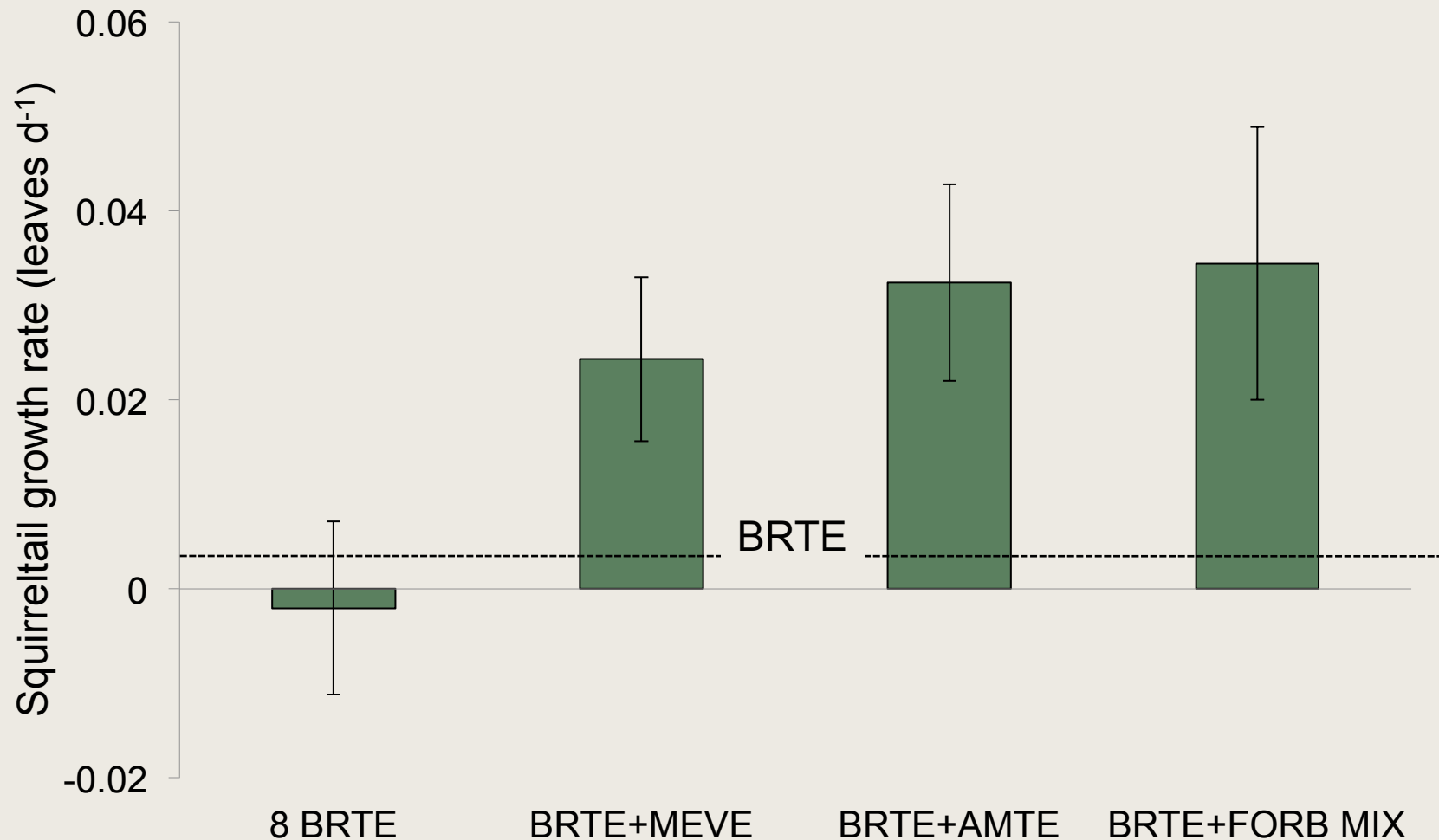
2. What are the **direct** and **indirect** effects of native annual forbs on squirreltail performance?



2. Direct Effect: Squirrelnail does better with native annuals!



2. Indirect Effects: When grown with cheatgrass, squirrel tail does better when native annuals are also present!



Greenhouse summary

- Fiddleneck shows promise as a good competitor against cheatgrass.
- Squirreltail grew better with native annuals, and native annuals also indirectly improve performance of squirreltail when cheatgrass is present.



Next steps

- Promote annual forbs!
- We need to learn more about our native annual forbs!
 - Germination strategies
 - Dormancy issues
 - Competitive abilities

Acknowledgements

- Great Basin Native Plant Selection and Increase Project
- University of Nevada, Reno





Questions?